





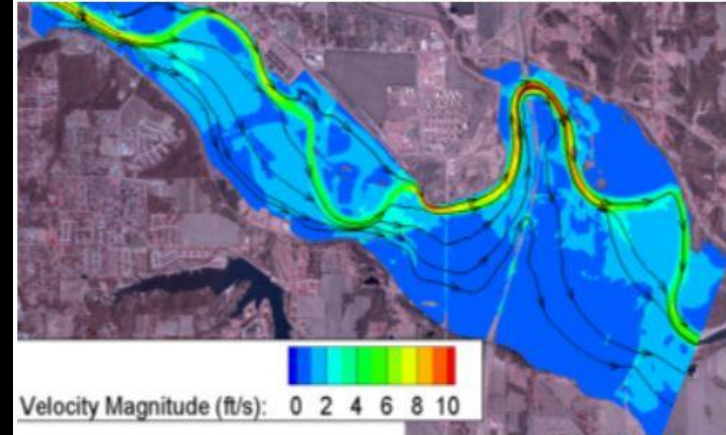
WHAT IS THIS “MODEL” YOU SPEAK OF?

Bridging the Communication Gap

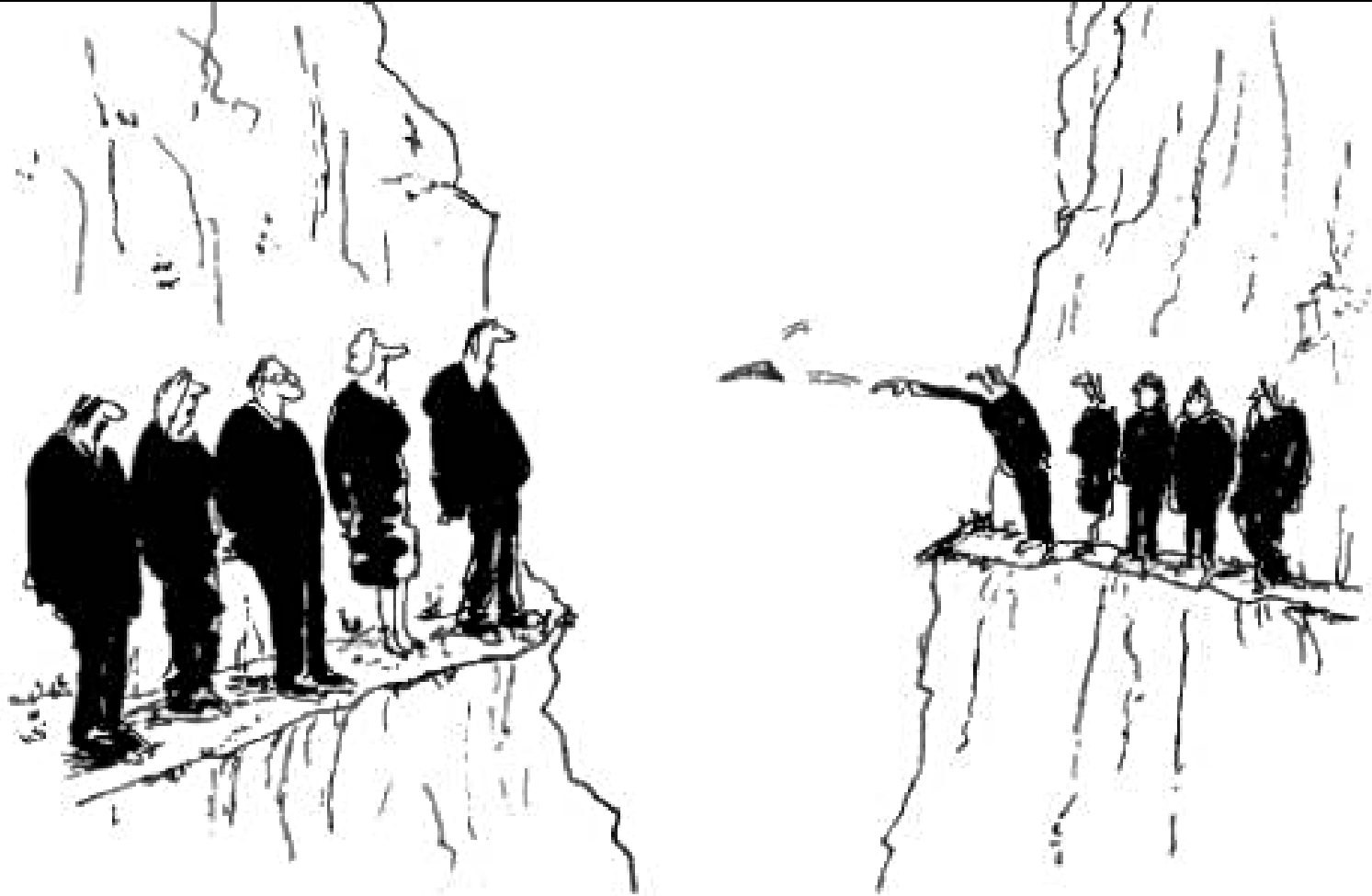


What am I talking about?

- Bridging the communications gap
 - Speaking technically to a non-technical audience
 - Avoid causing the “glazed gaze”
- Provide some background to what that engineer is saying
 - Deciphering or translating the technical language
 - What is a model?
- Latest improvements in hydraulic modeling
 - New features and capabilities



Bridging the Gap



Couldn't we communicate better if we built a bridge?

“Engineering Language”

- “Due to the numerous flow bifurcations, we utilized a finite volume model to simulate the complex hydraulic system using the full momentum version of the Saint-Venant equations.”
- What they meant to say; “We developed a model of the project area to represent the flood.”



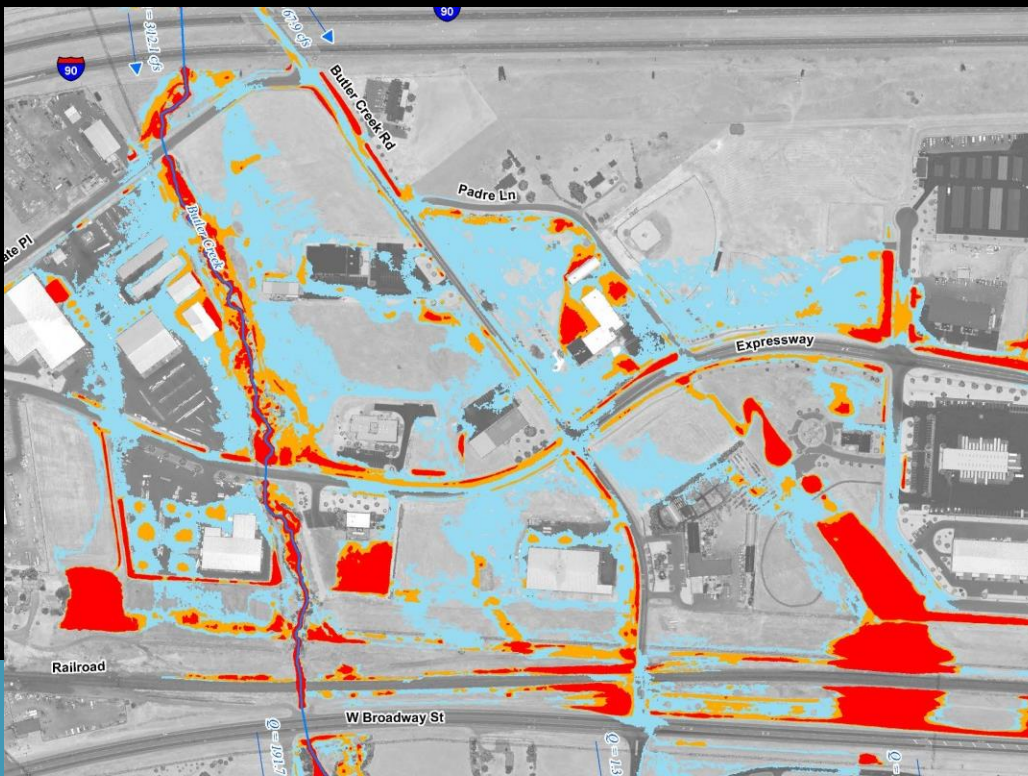
Simplify the Message

- Keep your audience in mind
 - Technical and non-technical
 - Mother rule or K.I.S.S.
- Define terms and don't interchange them
 - Use solely that one term
 - 1% annual-chance, 100-yr flood, Q100, base flood
 - » Not once every 100 years
 - Floodplain versus floodway
- Use memorable events
 - 2011 was 1,000 cfs, the represented event is 2,000 cfs
 - Helps with the “I’ve lived here 10 years and it’s never flooded.”
- Use images, figures, text on maps



Simplify the Message

- Avoid acronyms
 - BFEs and WSELs → Elevation of the flood
- Avoid modeling/technical talk
 - Headloss, Manning's roughness, conveyance, interpolation
- Avoid referencing FEMA and local guidelines
 - Appendix X.1.3 of such and such states that...
 - This is standard practice
- **Understand the audience's point of view**

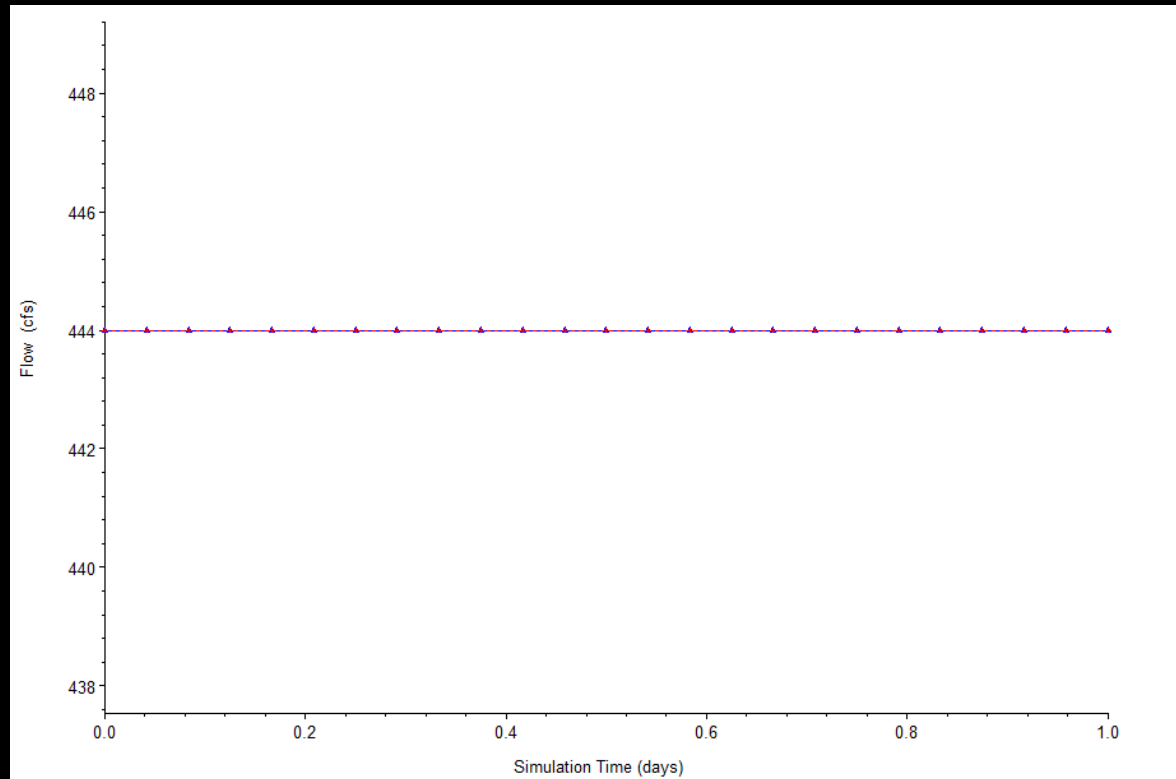


Technical Talk

- Discharge
- Steady state

Non-technical talk

- Flow (i.e. how much water)
- Discharge is constant over time

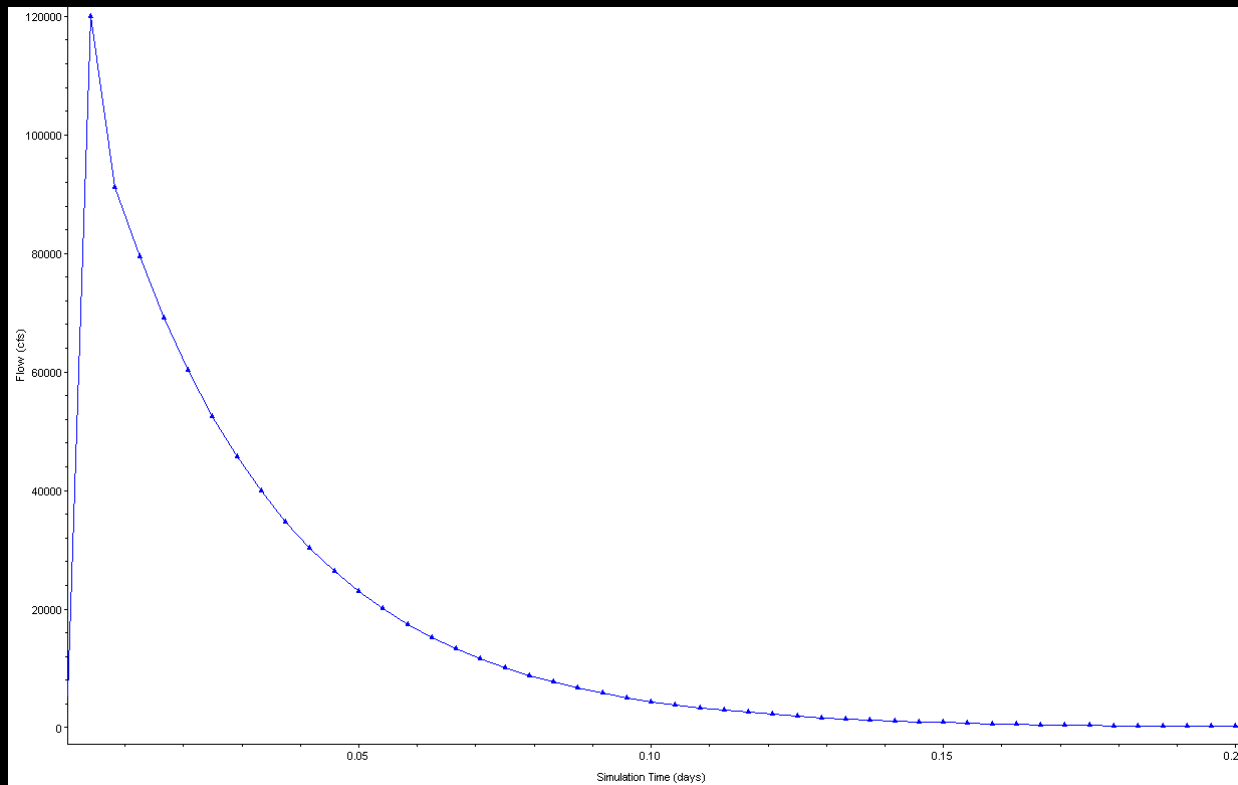


Technical Talk

- Discharge
- Steady state
- Unsteady state

Non-technical talk

- Flow (i.e. how much water)
- Discharge is constant over time
- Discharge changes over time



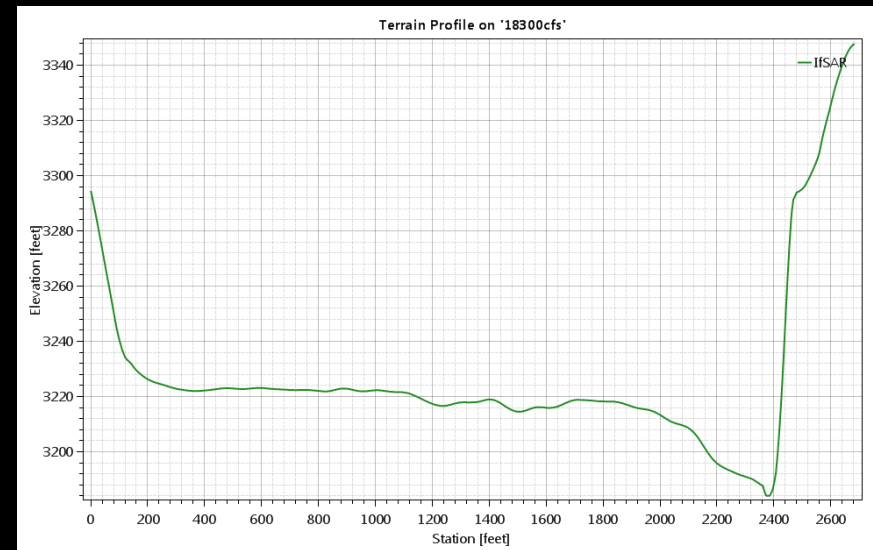
Technical Talk

- Discharge
- Steady state
- Unsteady state
- 1% annual-chance, 100-yr flood, Q100, base flood
- Roughness
- Topography
- **Cross section**
- Interpolation
- Model



Non-technical talk

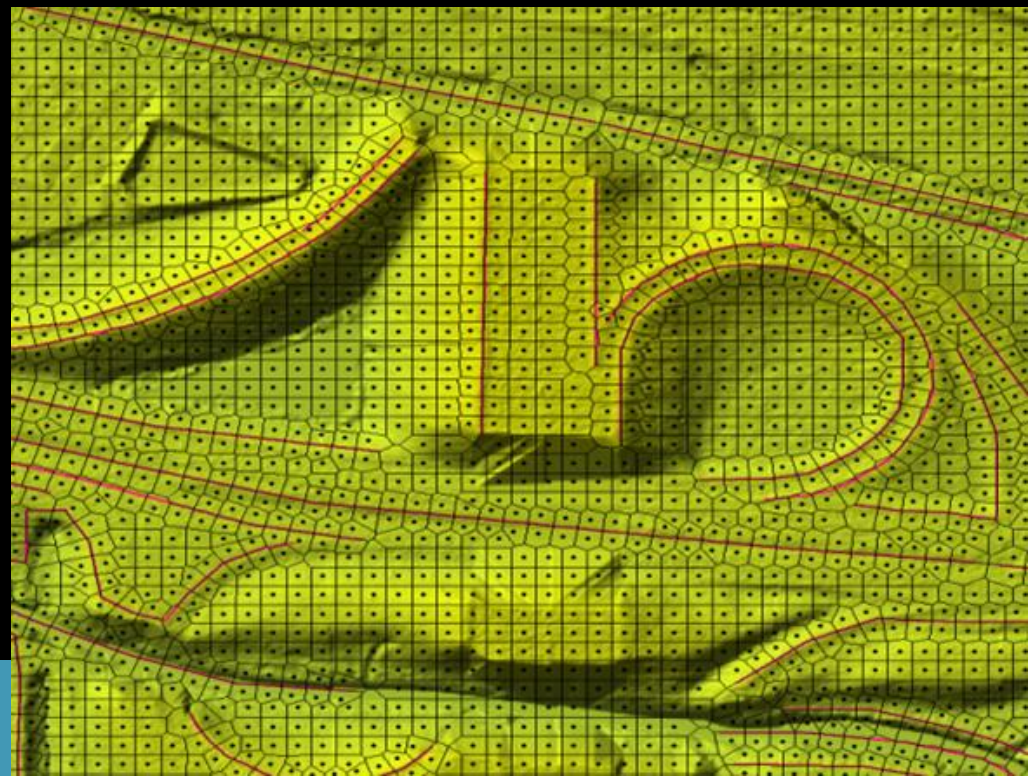
- Flow (i.e. how much water)
- Discharge is constant over time
- Discharge changes over time
- 1% chance of that discharge happening within the year
- Resistance to flow based on vegetation and smoothness of the surface
- Representation of the surface
- **Representation of the surface along a line**
- Straight line between two points
- ????



So...what is a hydraulic model?

- Set of calculations
- **Purpose:** Running numerous equations quickly
 - Similar to a group of spreadsheets talking to each other
- Allows for quick analysis
- Allows for simple comparisons of scenarios
- Most models include some form of mapping assistance

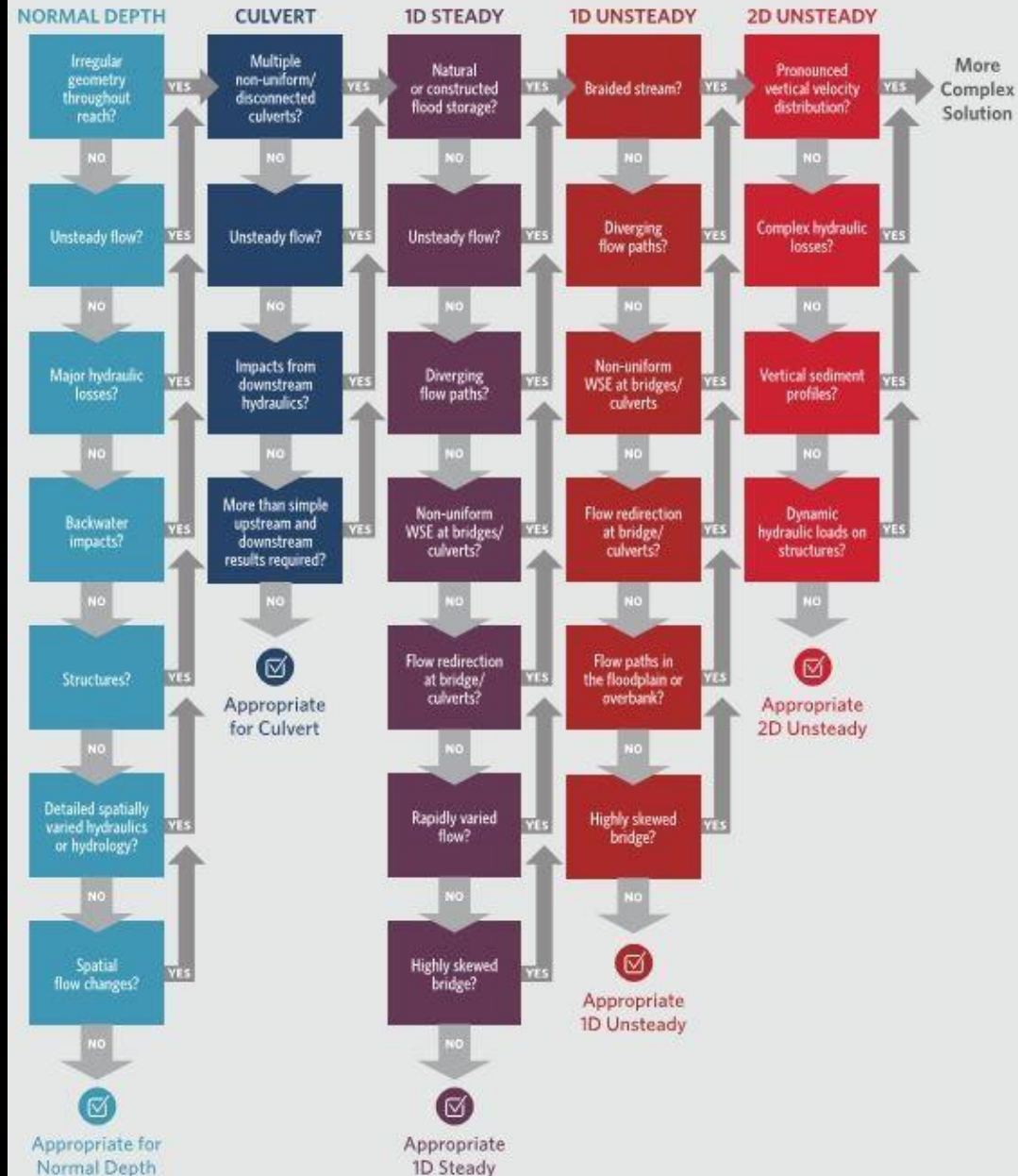
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800	5218.000	3121.700	5232.000	3119.500	5240.000	3118.600	5247.000	3118.500
900	5307.000	3114.400	5332.000	3114.500	5357.000	3114.800	5382.000	3114.900
000	5432.000	3115.200	5457.000	3115.600	5482.000	3118.600	5511.000	3121.300
100	5542.000	3124.900	5548.000	3123.900	5557.000	3124.200	5595.000	3124.900
200	5646.000	3125.300	5675.000	3125.600	5702.000	3125.300	5742.000	3125.200
300	5809.000	3122.500	5878.000	3121.600	6001.000	3121.400	6040.000	3122.000
400	6151.000	3122.800	6250.000	3122.000	6266.000	3124.400	6297.000	3121.700
500	6334.000	3120.300	6346.000	3120.300	6483.000	3122.100	6545.000	3121.700
600	6588.000	3124.400	6757.000	3125.200	6792.000	3125.200	6827.000	3120.200
700	6862.000	3120.900	6868.000	3123.200	6877.000	3120.200	6900.000	3120.200
800	7024.000	3127.600	7029.000	3127.900	7070.000	3127.200	7108.000	3127.500
900	7548.000	3124.000	7587.000	3124.400	7633.000	3123.100	7708.000	3128.000
000	7750.000	3130.900	7770.000	3129.200	7780.000	3132.300	7791.000	3134.800
100	7940.000	3144.200	8016.000	3162.100	8050.000	0.000	0.000	0.000
200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
300	90.000	1833.000	2120.000	3600.000	3450.000	3503.000	0.000	0.000
400	1456.000	3135.700	1474.000	3135.200	1483.000	3136.800	1490.000	3136.800
500	1508.000	3134.700	1521.000	3134.000	1543.000	3132.900	1594.000	3132.400
600	1729.000	3129.900	1770.000	3129.800	1813.000	3130.300	1833.000	3126.500
700	1846.000	3116.500	1859.000	3116.200	1883.000	3116.300	1908.000	3116.500
800	1959.000	3117.300	1986.000	3118.300	2010.000	3118.500	2035.000	3119.800
900	2085.000	3124.600	2115.000	3129.400	2120.000	3129.000	2128.000	3127.500
000	2154.000	3126.900	2173.000	3124.600	2186.000	3124.600	2196.000	3131.700
100	2251.000	3129.800	2307.000	3129.500	2368.000	3124.500	2429.000	3128.400
200	2483.000	3129.000	2523.000	3128.700	2561.000	3127.800	2601.000	3128.100
300	2636.000	3123.200	2651.000	3122.600	2660.000	3126.500	2676.000	3130.400
400	2732.000	3131.600	2775.000	3131.800	2812.000	3130.900	2844.000	3129.500
500	2935.000	3130.500	2939.000	3133.300	2955.000	3134.400	2994.000	3134.400
600	3033.000	3134.700	3050.000	3133.200	3056.000	3133.800	3059.000	3133.800
700	3066.000	3133.700	3078.000	3132.500	3095.000	3133.000	3126.000	3134.000
800	3210.000	3133.800	3249.000	3133.300	3301.000	3133.200	3341.000	3134.100
900	3560.000	3135.500	3585.000	3136.500	3605.000	3136.100	3649.000	3136.100
000	3717.000	3136.200	3743.000	3135.900	3765.000	3136.600	3810.000	3137.300
100	3936.000	3137.900	4004.000	3138.100	4063.000	3138.700	4135.000	3137.000
200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

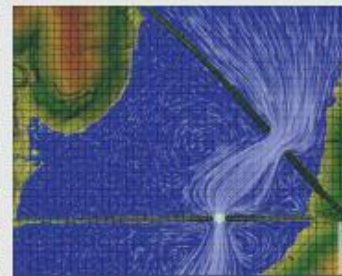
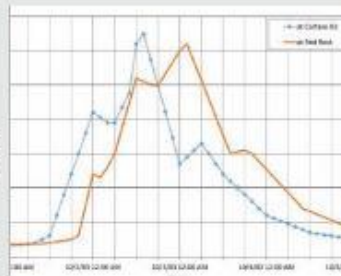
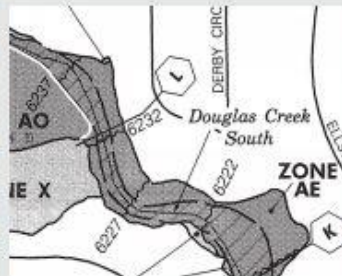


What kind of model?

Depends on what you want to know and the system.

- Single cross section
- Structure (i.e. culvert at a roadway)
- Single channel with connected floodplain
- Channel and/or floodplain splits
- System experience flood over days or it all happens within hours
- Analyzed system enclosed
- Analyzing temperature, sediment, turbulence, or habitat





NORMAL DEPTH

- » FlowMaster
- » Hydraulic Toolbox

CULVERT

- » HY-8
- » CulvertMaster

1D STEADY

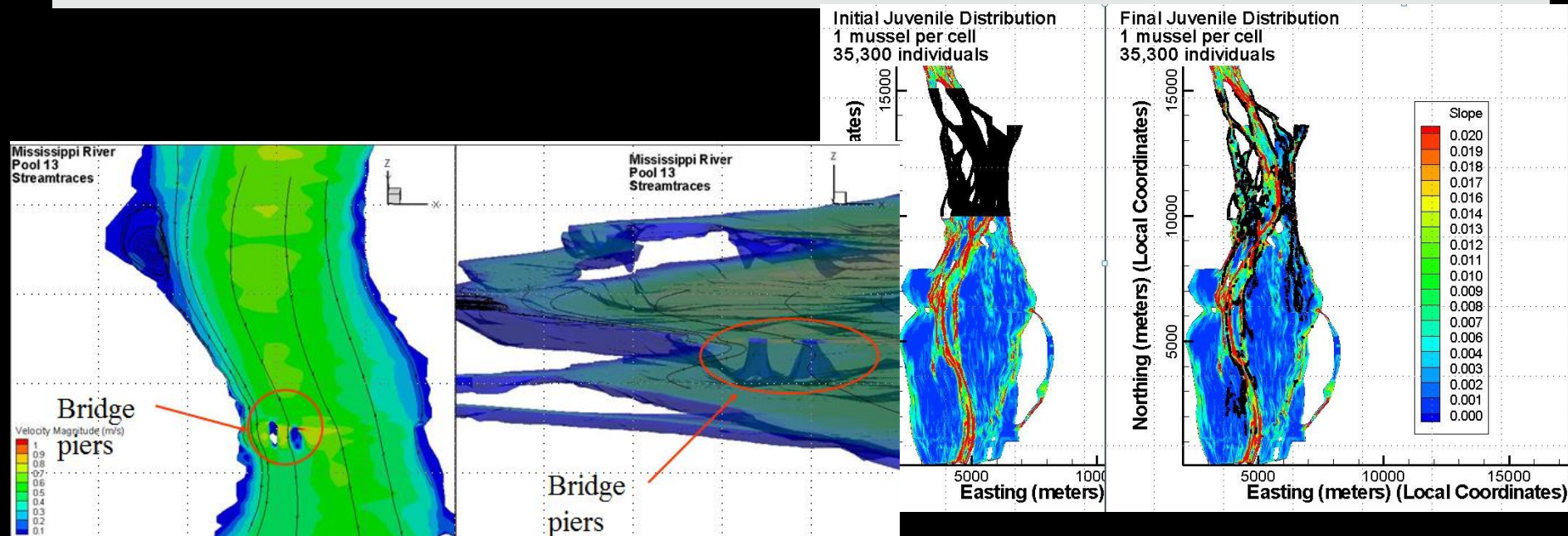
- » HEC-RAS
- » MIKE 11
- » XPSWMM
- » SWMM 5

1D UNSTEADY

- » HEC-RAS
- » MIKE 11
- » XPSWMM
- » SWMM 5
- » TUFLOW

2D UNSTEADY

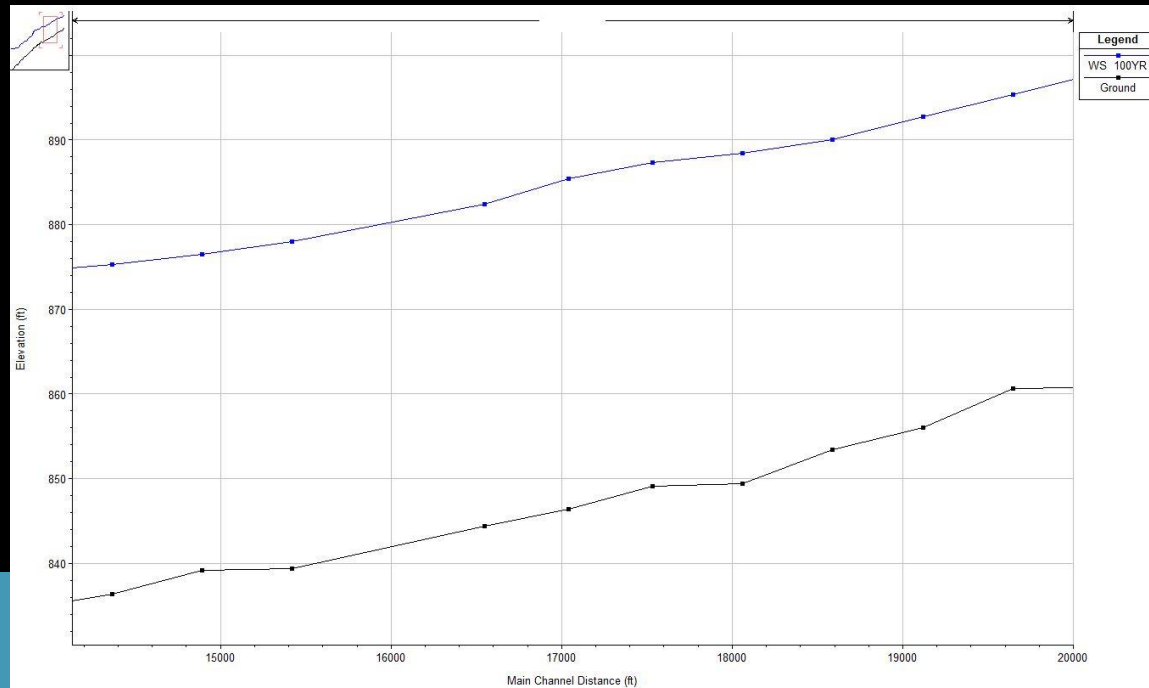
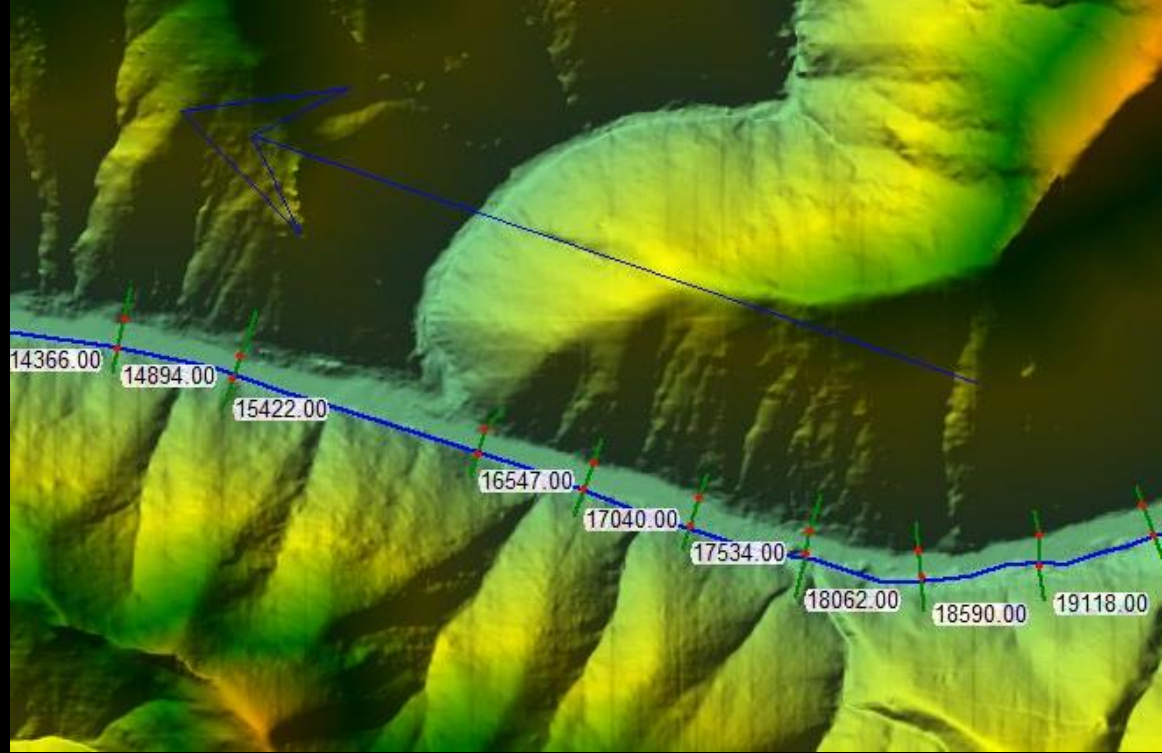
- » HEC-RAS
- » SRH-2D
- » FLO-2D
- » MIKE 21
- » TUFLOW
- » XPSWMM
- » RiverFlow2D
- » TrimR2D
- » MIKE FLOOD
- » SWMM 5



Modeling Floodplains Typically

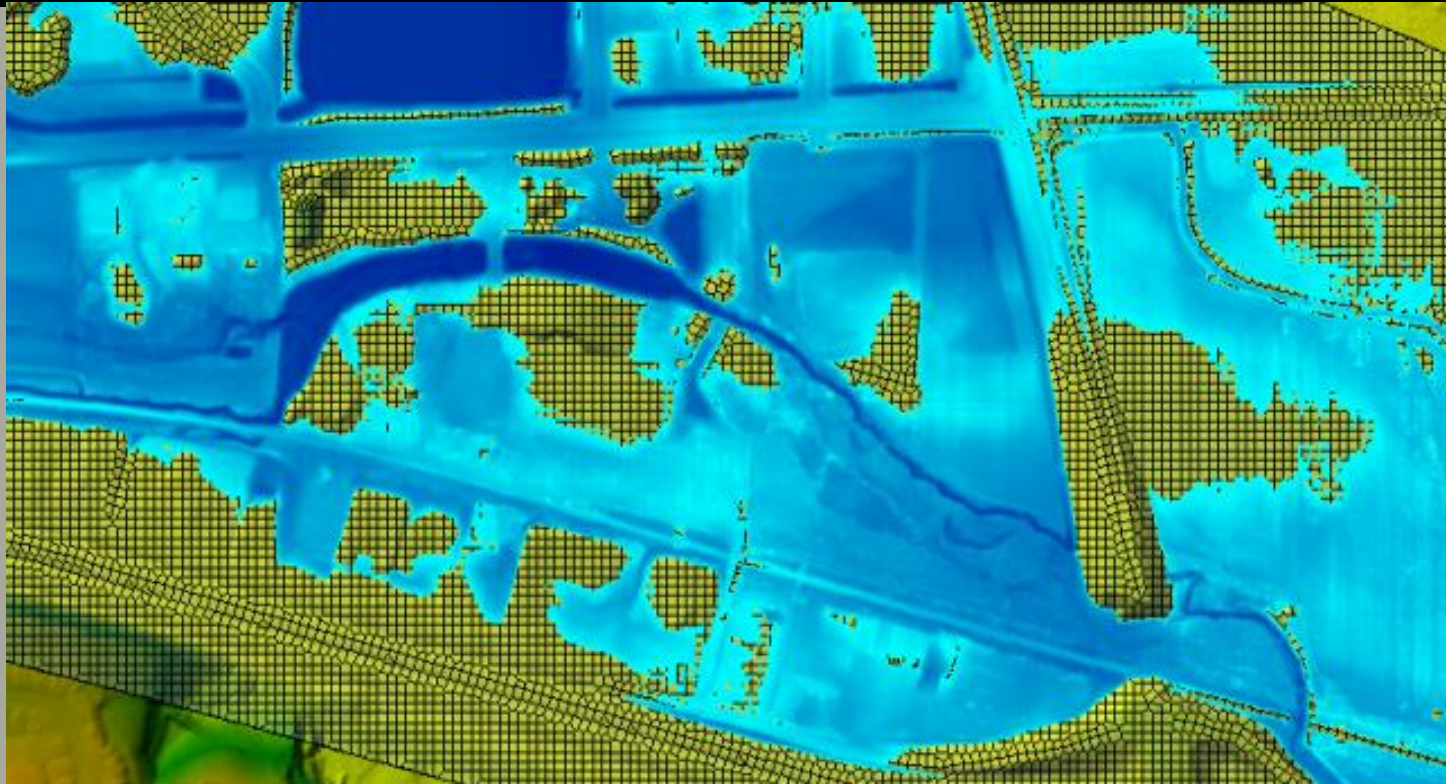
- HEC-RAS
- MT is typically performed using steady state
- Based on numerous cross section locations
 - Placement decided by engineer
- Can incorporate bridges and culverts
- Solution between cross sections
- Review output and adjust

Much more than “just hit run.”



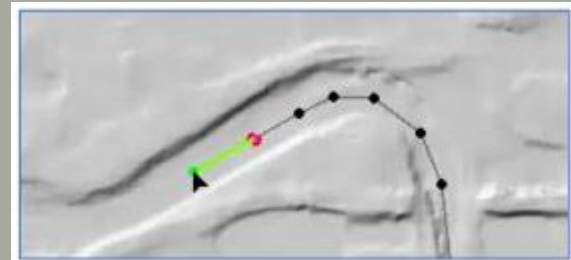
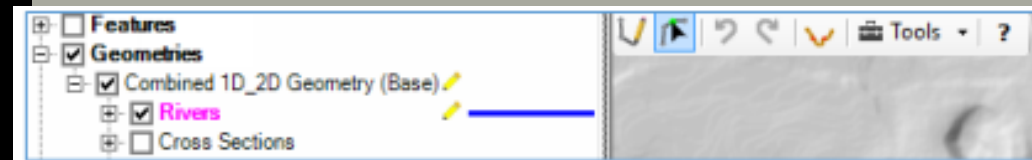
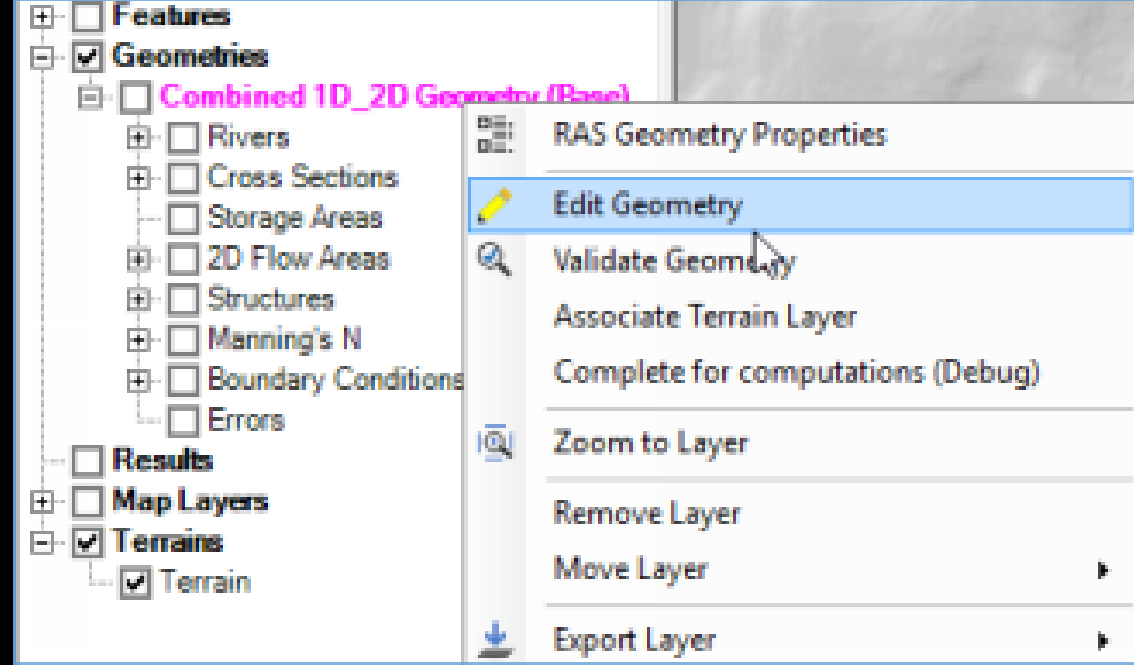
HEC-RAS Version 5.0.4 Update

- What is new
 - Beta testing 5.0.4
- What is in the plans



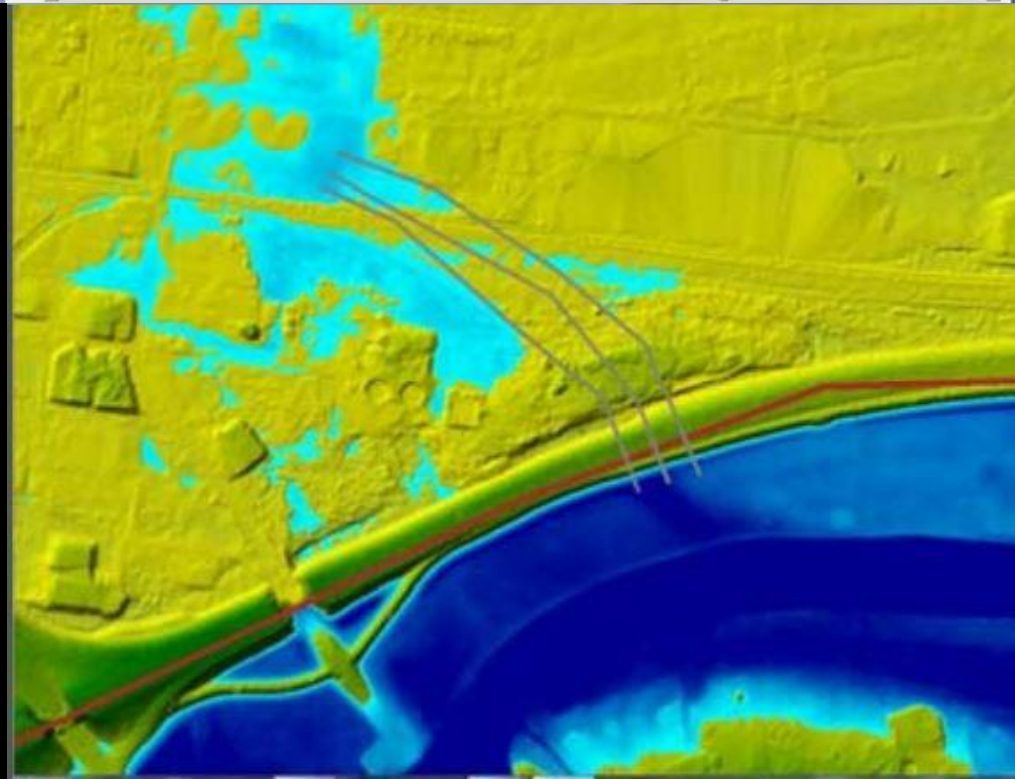
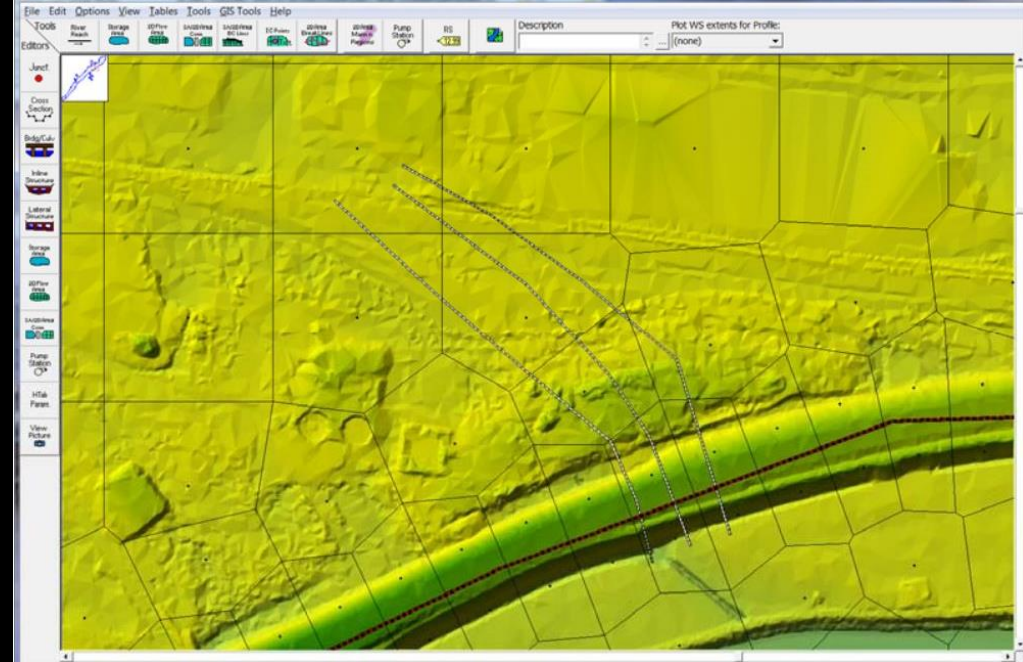
5.0.4 Modifications

- New RAS Mapper Pre-Processor Tools
 - Extraction of elements
 - Rivers
 - Cross sections
 - Storage Area
 - 2D elements
 - Manning's roughness layer



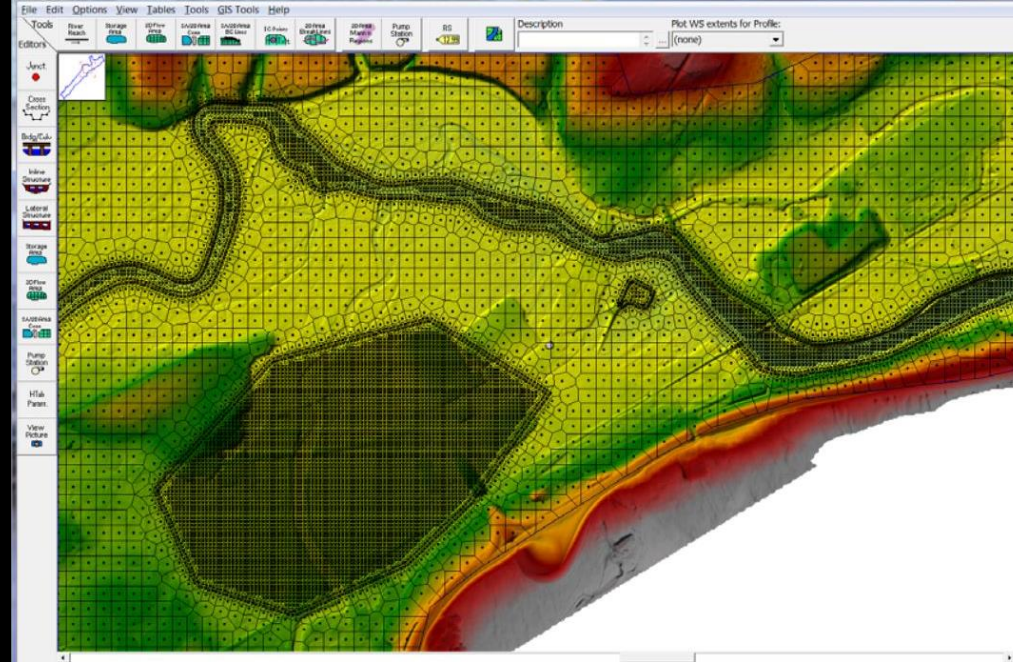
5.0.4 Modifications

- Enhancements to Storage Area / 2D Connections
 - Ability to specify the X and Y coordinates for U/A and D/S ends of each hydraulic outlet



5.0.4 Modifications

- New breakline controls
- New polygon mesh refinement tool
 - Define a new grid size within a defined polygon



5.0.4 Modifications

- Variable Time Step
 - Both 1D and 2D Simulations
 - Two Methods:
 - Based on Courant Number monitoring
 - User defined table of dates and time steps

General | 2D Flow Options | 1D/2D Options | Advanced Time Step Control | 1D Mixed Flow Options

☐ Fixed Time Step (Basic method) 0.5 Second ▼

☒ Adjust Time Step Based on Courant

Maximum Courant: 1.
 Minimum Courant: 0.5
 Number of steps below Minimum before doubling: 10
 Maximum number of doubling base time step: 1 1.00 sec
 Maximum number of halving base time step: 1 0.25 sec

Courant Methodology
☒ Courant (Velocity * dt / Length)
☐ Residence Time (flow out * dt / Volume)

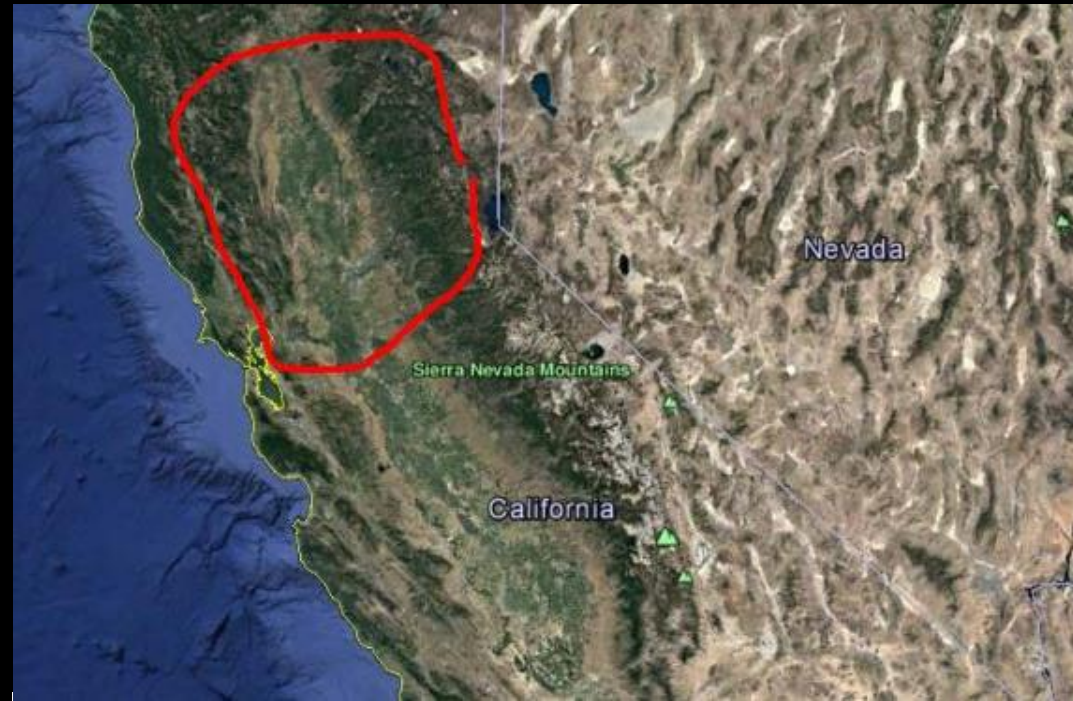
☐ Adjust Time Step Based on Time Series of Divisors Verify Dates ...

	Time Step	Date(ddMMMyyyy hhmm)	Divisor	
1				
2				
3				
4				
5				
6				
7				
8				

RAS Version	Timestep (s)	Error (%)	Run Time (min)
5.0.3	1	0.220	74
5.0.3	0.5	0.210	184
5.0.4	0.25 - 1	0.004	42

5.0.4 Modifications

- Internal Boundary Conditions Lines in 2D Area
 - User defines a BC line internally
 - Able to define a hydrograph
- 64-bit Version of RAS Mapper
 - Larger domains, terrain sets
 - Improved results processing
- 64-bit 2D Processor
 - Larger domain
 - Faster processing
- Computational Engine further parallelized

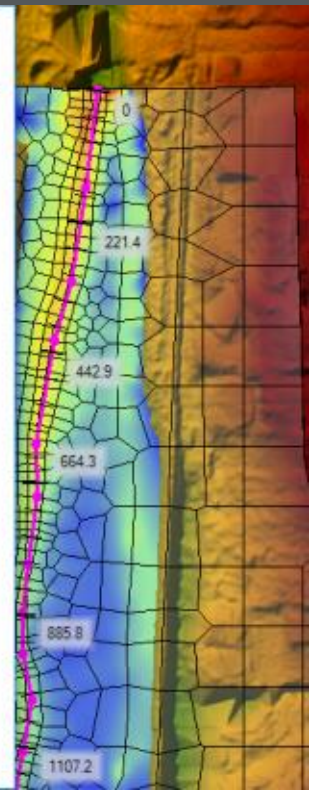
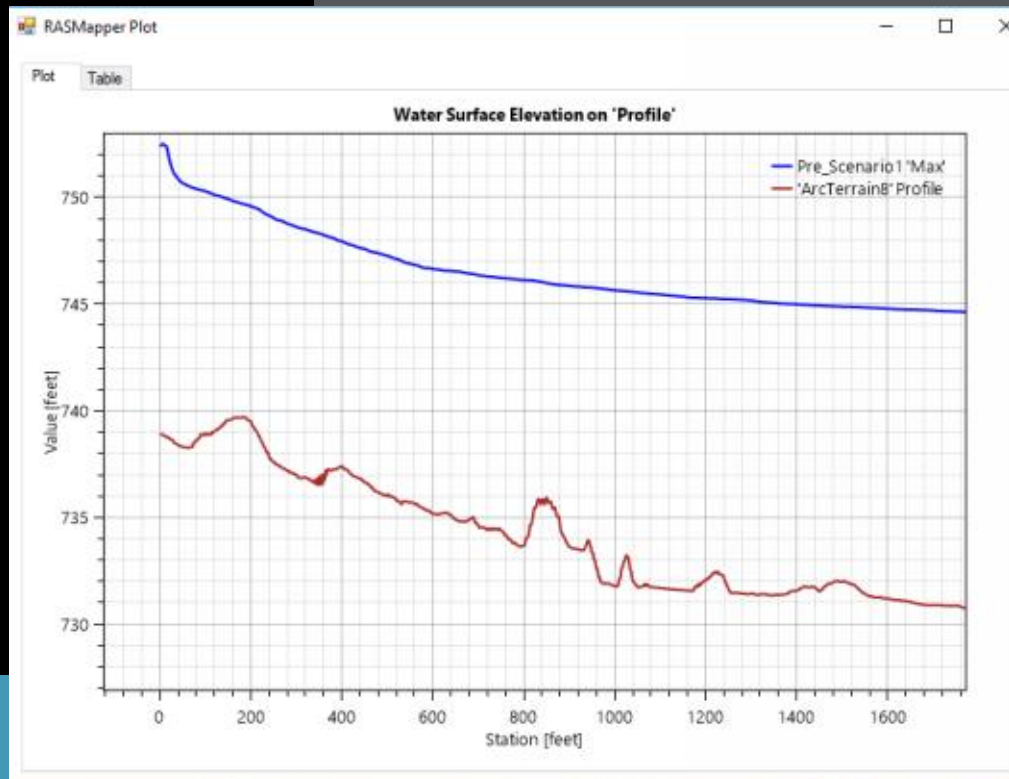


2D Test Name	5.0.3 Compute time	5.0.4 Compute time
EU Test No 2 10,000 cells	1min 6s	31s
EU Test No 4 80,000 cells	1 min 27s	56s
EU Test No 4 20,000 cells	27s	13s
EU Test No 5 7,460 cells	1min 40s	49s
EU Test No 5 1,809 cells	24s	13s
EU Test No 6 36,492 cells	2 min 41s	1 min 18s
EU Test No 7 16,590 cells	38 min 46s	15 min 35s
EU Test No 7 4,195 cells	15 min 47s	3 min 48s
Muncie 25ft Grids 21,724 cells	19 min 10s	8 min 52s
Cherry Cr Dambrk 55,931 cells	43 min 15s	15 min 38s
Yolo Bypass 17,141 cells	17 min 13s	9 min 15s
Boise River 10,423 cells	28 min 2s	11 min 27s
Oroville Dam Brk 133,368 cells	5 hr 46 min 29s	1 hr 57 min 24s

Graphics and table provided by Gary Brunner (HEC)

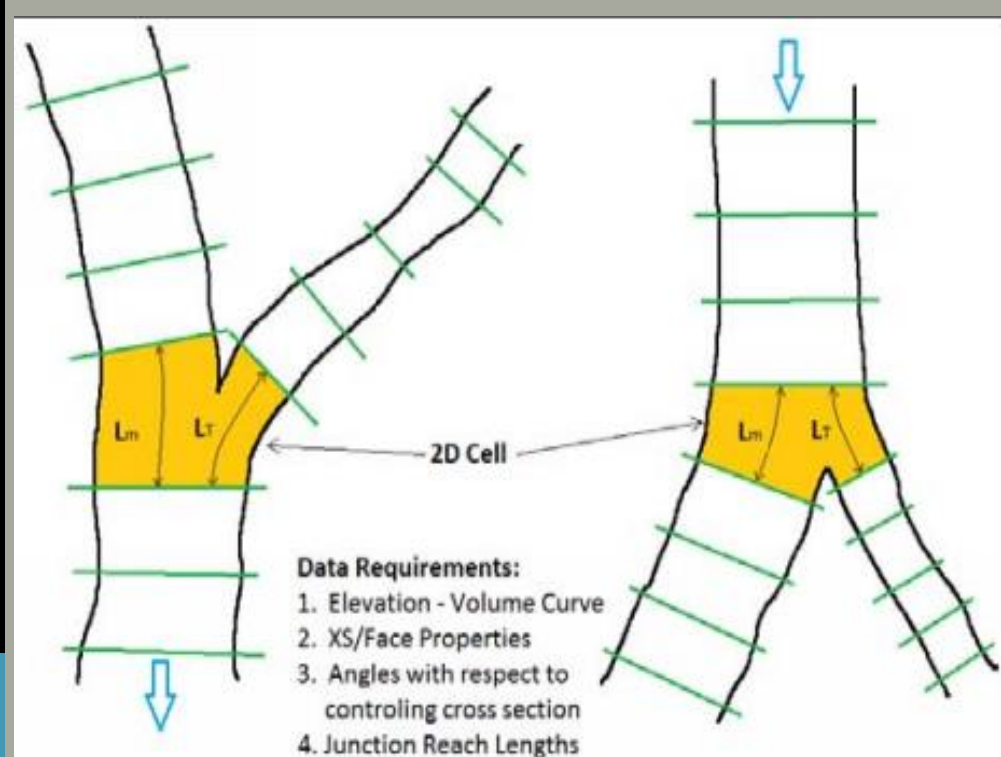
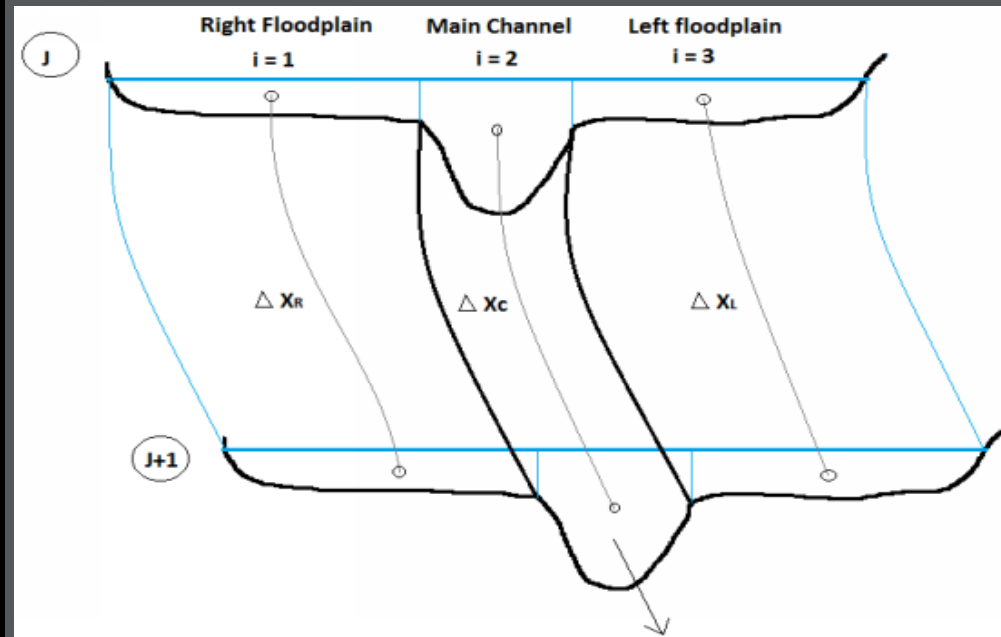
5.0.4 Modifications

- New Velocity Term for 2D Boundary Conditions
 - New approach estimates starting velocity
- Sediment
 - New grain class options
 - New transport functions
- Bug Fixes
 - Velocity fields
 - Less sensitive to grid sizes
 - Dry/Wet cell interfaces



5.1 Release

- 1D Finite Volume Solver
 - More stable solution
 - Improvements in transitions between flow regimes
- Junction analysis performed as a single 2D cell



Graphics and table provided by Gary Brunner (HEC)

5.1 Release

- Enhancements to Mesh Generation Tools
- Initial Conditions for 2D Areas
 - Polygon and point values for setting initial conditions
- Pump Stations in 2D Domain
- Output for internal SA/2D Connections
- Spatially Varied Precipitation and Infiltration
- Wind Forces
- 2D Mesh Importer
 - SMS meshes: ADH, SRH and Tuflow
- Use DSS7 libraries
 - Smaller time steps
 - » Currently 1 min in DSS6

Questions?